PROC. BIOL. SOC. WASH.
99(4), 1986, pp. 709–716

ASTYANAX SCOLOGASTER, A NEW CHARACID (PISCES: OSTARIOPHYSI) FROM THE RÍO NEGRO, SOUTH AMERICA

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Abstract.—*Astyanax scologaster* is described from a series of localities in the middle and upper Río Negro of Venezuela and Brazil. The presence of exserted anterior spines of the pelvic bones serve to define a subunit of *Astyanax* consisting of the relatively small-sized species *A. scologaster, A. essequibensis, A. mucronatus,* and *A. zonatus.* The extensive development of the exserted pelvic spine, large eye diameter, branched anal-fin ray count, number of pored lateral-line scales, and pigmentation pattern of *Astyanax scologaster* delimit that species within this assemblage.

The presence of exserted strong spine-like pelvic bones which project anteriorly from the anteroventral body wall was first noted for characids by Eigenmann (1911:180, and Fig. 2) in his description of *Deuterodon acanthogaster.* In that species account Eigenmann noted a similar condition for *Astyanax mucronatus* Eigenmann, although no mention of the modification had been made in the original description (Eigenmann 1909: 19–20) and subsequent treatments of that species until 1921. In that year, Eigenmann (p. 280) inserted "... *innominate bones protruding as spines in front*" in his redescription of *Astyanax mucronatus.* Recent collecting efforts in the Río Negro basin of Venezuela and Brazil have revealed the presence of an undescribed *Astyanax* species with very well developed anteriorly exserted pelvic bones. Comparative studies associated with the description of the new species have uncovered the presence of comparable spines in individuals of three additional *Astyanax* species and in a second *Deuterodon* species.

Materials and methods.—Counts and measurements in the description follow the methods outlined in Fink and Weitzman (1974). All measurements are given as percentages of standard length (SL) except for subunits of the head which are presented as percentages of head length (HL). Vertebral counts were taken from radiographs and cleared and counterstained specimens. This number includes the four vertebrae incorporated into the Weberian apparatus and considers the fused $PU_1 + U_1$ as a single element. In the meristic values detailed, the range of the holotype and measured paratypes is presented first, with the value for the holotype indicated in brackets.

The following abbreviations are used for institutions: AMNH, American Museum of Natural History, New York; ANSP, Academy of Natural Sciences of Philadelphia; BMNH British Museum (Natural History), London; CAS, California Academy of Sciences, San Francisco; FMNH, Field Museum of Natural History, Chicago; MBUCV, Museo de Biologia, Instituto de Zoologia Tropical, Universidad Central de Venezuela, Caracas; MZUSP, Museu de Zoologia da Universidade de São Paulo, São Paulo; and USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Astyanax scologaster, new species
Figs. 1 and 3, Table 1

Holotype.—MBUCV V-15249, 37.5 mm SL, Venezuela, Territorio Federal Amazonas, Departamento Río Negro, lower por-

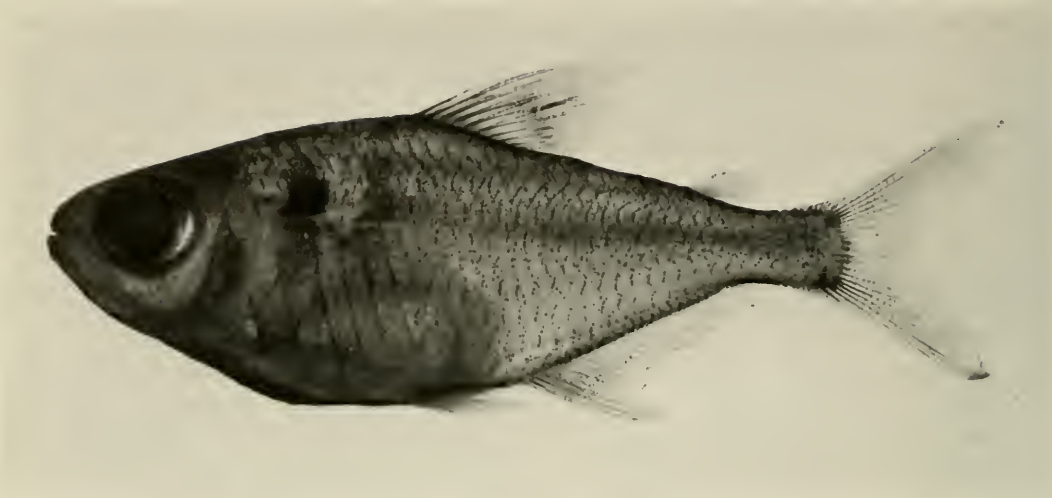

Fig. 1. *Astyanax scologaster*, new species, holotype, MBUCV V-15249, 37.5 mm SL, Venezuela, Caño Manu.

tion of Caño Manu, which drains into the Río Casiquiare about 250 m upstream of Solano (approx. 02°00′N, 66°57′W); coll. R. P. Vari, C. J. Ferraris, Jr., O. Castillo, and J. Fernandez, 7 Dec 1984.

Paratypes.—(All from Venezuela, Territorio Federal Amazonas, Departamento Río Negro, unless noted otherwise): MBUCV V-15250, 5, 28.8–37.2 mm SL; USNM 272612, 8, 24.5–36.2 mm SL (4, cleared and counterstained for bone and cartilage); AMNH 56173, 3, 27.5–30.0 mm SL; ANSP 157596, 3, 26.7–28.6 mm SL; BMNH 1985.10.14:1–3, 3, 26.9–30.0 mm SL; CAS 57471, 3, 24.9–35.0 mm SL; FMNH 96616, 3, 26.5–29.6 mm SL; MZUSP 36288, 3, 24.7–29.9 mm SL; taken with the holotype.—AMNH 56174, 5, 38.7–40.7 mm SL; USNM 276503, 5, 39.6–42.0 mm SL; MBUCV V-15251, 5, 38.0–40.6 mm SL, Río Negro at San Carlos de Río Negro, 2 Feb 1984.—USNM 272609, 4, 35.3–36.0 mm SL, Caño Chola, where crossed by road from San Carlos de Río Negro to Solano (01°58′N, 67°00′W), 5 Dec 1984.—USNM 272611, 5, 29.6–33.0 mm SL, Río Negro, one-half hour upstream of San Carlos de Río Negro, 4 Dec 1984.—USNM 272610, 5, 32.2–36.0 mm SL, San Carlos de Río Negro, Río Negro margin upstream of town landing, 3 Dec 1984.—MZUSP 30252, 6, 31.8–38.9 mm SL; USNM 276505, 6, 37.0–41.4 mm SL, Brazil, Amazonas, Rio Negro, Massarabi, sandy beach just above Barcelos (approx. 00°57′S, 62°56′W), 18 Oct 1979.—MZUSP 30247, 6, 32.7–37.3 mm SL; USNM 276504, 5, 35.7–39.8 mm SL, Brazil, Amazonas, Rio Negro, beach, Ilha Tamaquaré just downstream from Tapurucuara (approx. 00°25′S, 64°55′W), 10 Oct 1979.

The following non-type specimens were also examined: USNM 276502, 14; MBUCV V-15253, 24; Río Negro, one-half hour upstream of San Carlos de Río Negro.—USNM 276501, 15, San Carlos de Río Negro, Río Negro margin, upstream of town landing.—AMNH 56175, 33; MBUCV V-15252, 20, Río Negro at San Carlos de Río Negro.

Diagnosis.—The presence of prominent anteriorly divergent pelvic bones that are exserted in most individuals of *Astyanax scologaster* distinguishes the species from other characids with the exception of *A. mucronatus* Eigenmann, *A. essequibensis* Eigenmann, *A. zonatus* Eigenmann, *Deuterodon pinnatus* Eigenmann and *D.*

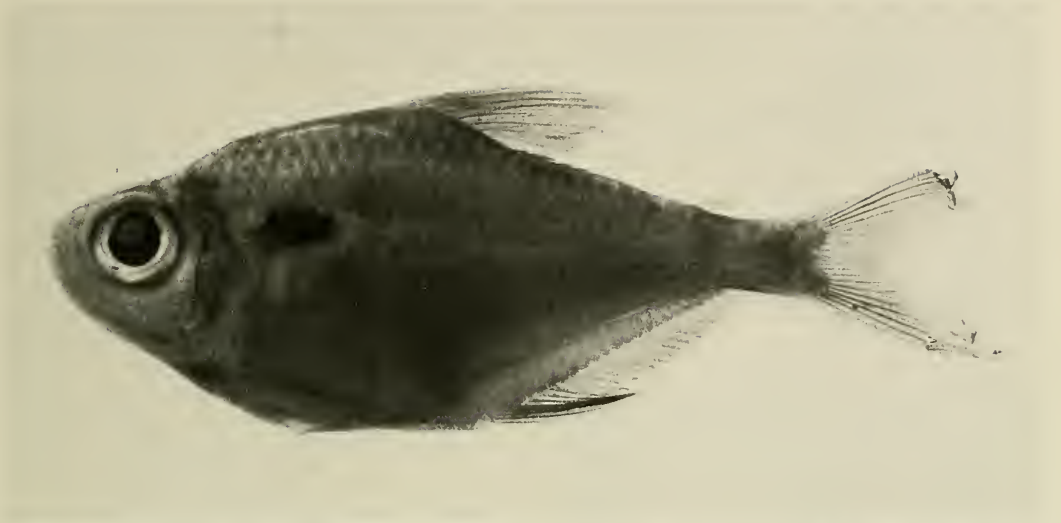

Fig. 2. *Astyanax mucronatus* Eigenmann, cotype, FMNH 53521, 54.6 mm SL, Guyana, Potaro River, Tukeit.

acanthogaster Eigenmann. *Astyanax scologaster,* as other *Astyanax* species, has strong central cusps on all teeth and an abrupt change in the size of the teeth on the dentary which distinguishes the new species from all *Deuterodon* species which have flattened teeth without strong central cusps, and dentary teeth in a graduated size series. *Astyanax scologaster* has 21 or 22 branched anal-fin rays compared with 24 or 25 in *A. mucronatus,* 19 or 20 in *A. essequibensis,* and 25 to 29 in *A. zonatus. Astyanax scologaster* has 33 to 35 scales in the lateral series versus 40 to 45 for *Astyanax zonatus.* Although the pigmentation patterns of *Astyanax scologaster* and *A. mucronatus* are similar, the anterior humeral spot of *A. scologaster* is narrower and more vertically elongate than the horizontal wedge-shaped humeral spot of *A. mucronatus* (compare Figs. 1 and 2). The relatively large eye of *Astyanax scologaster* (42.2–48.8% of HL) distinguishes that species from *A. zonatus* (37.7–40.6% of HL) and *A. essequibensis* (38.5–44.0% of HL). *Astyanax scologaster* is not as deep bodied as *A. mucronatus* (34.9–42.1 vs. 36.9–45.4% of SL; compare also Figs. 1 and 2), but deeper bodied than *A. essequibensis* (30.7–36.8% of SL) or *A. zonatus* (31.8–35.9% of SL).

Description.—Table 1 gives morphometrics of holotype and measured paratypes. No evidence of sexual dimorphism in meristics or morphometrics was found. Body moderately deep, somewhat compressed, broadest in region of exsertion of pelvic spines in both sexes. Greatest body depth between origins of dorsal and pelvic fins, except in population from Massarabi in which greatest depth is in region of pelvic-spine exsertion, about midway between origins of pectoral and pelvic fins. Origin of dorsal fin closer to tip of snout than to hypural joint and often anterior to vertical line through origin of pelvic fin. Distance from snout to pelvic-fin origin ($\bar{x}$ = 50.9% of SL) usually greater than distance from snout to dorsal-fin origin ($\bar{x}$ = 49.2% of SL). Dorsal profile of head and body slightly convex from dorsal to orbit to dorsal-fin origin. Dorsal profile of body along dorsal-fin base nearly straight, posteroventrally oriented, nearly straight to slightly convex between dorsal and adipose fins. Caudal peduncle slender, compressed, rather short. Ventral profile of body slightly convex from sym-

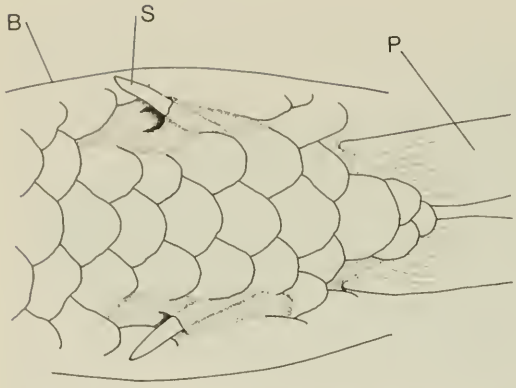

Fig. 3. *Astyanax scologaster,* new species, USNM 276503, 42.0 mm SL. Ventral view of pelvic-fin insertion and anteriorly proximate portion of body showing anteriorly divergent, exserted pelvic bones. Area in stipple pattern is without scales. S, pelvic spine. P, pelvic fin. B, body profile.

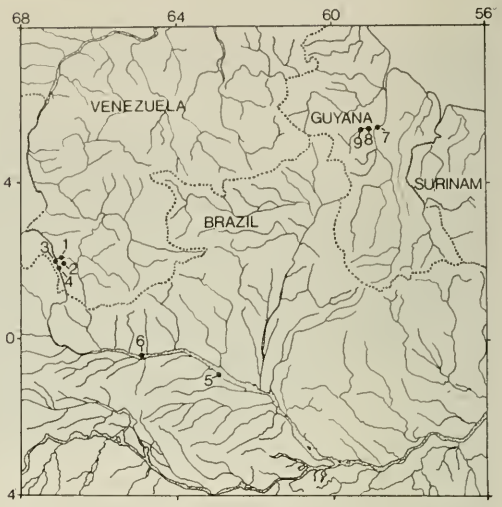

Fig. 4. Map of portion of northern South America showing collecting localities of specimens of *Astyanax scologaster,* new species, *A. mucronatus* Eigenmann and *A. essequibensis* Eigenmann reported on in this paper (dotted lines depict international boundaries). Localities 1 to 6 are collection sites of *A. scologaster*: 1, Caño Manu; 2, Caño Chola; 3, upstream of San Carlos de Río Negro; 4, San Carlos de Río Negro; 5, Massarabi; 6, Ilha Tamaquaré. See listing of holotype, paratypes, and non-type specimens examined for detailed locality and collection information. Localities 7 to 9 are collection sites of *A. mucronatus* and *A. essequibensis*: 7, Crab Falls; 8, Tumatumari; 9, Tukeit. See listing of "Comparative Material Examined" for more detailed locality information.

physis of lower jaw to origin of pelvic fin, sometimes with sharp angle at point of pelvic-spine exsertion from body; body transversely rounded anterior to this fin. Profile nearly straight between pelvic and anal fins (or nearly straight between pelvic-spine exsertion and anal-fin origin as in Fig. 1); straight and posteroventrally oriented along base of anal fin. Ventral profile of caudal peduncle slightly concave.

Head length moderate, slightly more than one-quarter of standard length, snout rounded in profile, moderate in length, jaws equal and mouth terminal, or lower jaw slightly shorter and mouth barely subterminal. Mouth nearly horizontal or slightly posteroventrally slanted; gape moderate, wider than snout length. Eye large. Interorbital width moderate, flat to slightly rounded transversely, but narrower than upper jaw width. Maxilla long, slightly lobed posteriorly; reaching slightly posterior to vertical line through anterior border of eye, and ventral to horizontal line through ventral border of eye.

Maxilla with 3 to 5 very small compressed teeth; usually with 4 cusps, but with 5 cusps in some populations, third cusp longest. Premaxillary teeth in two series. Outer series usually in rather uneven row of 4 teeth of differing forms; third tooth from symphysis narrower, rather round in cross section, and with 3 cusps. Remaining teeth of outer premaxillary series broader, more ovoid in cross section, with at least a very small additional pair of cusps for a total of 5. Inner series of premaxillary teeth consisting of 5 broad teeth extending across gape. Each tooth with prominent central cusp flanked by two or, more usually, three pairs of cusps of decreasing size arranged in semicircle progressing around anterior border of tooth. Lateralmost premaxillary tooth smaller, semi-compressed, sometimes almost indistinguishable in form from dorsalmost maxillary tooth. Dentary with 5 large teeth along anterodorsal margin of

Table 1.—Morphometrics of *Astyanax scologaster*, new species. Standard length is expressed in mm; measurements 1 to 12 are percentages of standard length; 13 to 16 are percentages of head length.

	Holotype	Paratypes (59)	
		Range	Average
Standard length	37.5	28.8–42.0	
1. Greatest body depth	38.9	34.9–42.1	38.2
2. Snout to pelvic-fin origin	50.1	48.3–53.2	50.9
3. Snout to dorsal-fin origin	48.3	47.3–52.0	49.2
4. Dorsal-fin origin to caudal base	56.0	53.6–57.6	55.6
5. Snout to anal-fin origin	64.3	61.9–67.4	64.1
6. Caudal peduncle length	12.3	11.2–13.6	12.5
7. Caudal peduncle depth	9.9	8.8–10.6	9.7
8. Pelvic-fin length	16.8	15.1–18.3	17.0
9. Length pelvic bone	10.9	10.0–12.6	11.5
10. Distance between exserted tips of pelvic bones	8.3	5.3–14.2	9.4
11. Snout to pectoral-fin origin	28.5	26.5–30.3	28.6
12. Bony head length	28.8	27.7–31.2	29.6
13. Horizontal eye diameter	46.3	42.2–48.8	45.9
14. Snout length	29.6	23.6–31.1	27.4
15. Upper jaw length	42.6	38.4–44.0	41.4
16. Bony interorbital width	29.6	26.7–34.2	30.6

bone. Large dentary teeth similar in form to inner premaxillary teeth, fitting closely behind latter when mouth closed. Central cusp long and strong; usually flanked by two pairs of smaller cusps. Larger dentary teeth followed posteriorly by 6 to 8 very small teeth with 1 to 3 uneven cusps.

Infraorbital series complete, all elements relatively small, ventral and posterior infraorbitals not contacting sensory tube of preopercle. Frontoparietal fontanel extending into posterior portion of ethmoid; parietals completely separated; frontals in contact only at epiphyseal bar. Fontanel gradually widening posteriorly, extending onto dorsomedial portion of supraoccipital. Supraoccipital spine moderately developed. Adipose eyelid (a thick band of clear connective tissue) extending posteriorly from nostrils over lateral surface of head and anterior midlateral portion of body to anterior humeral spot; with large, almost circular opening over eye.

Dorsal-fin rays ii,8,i or ii,9 [ii,9]; second unbranched ray usually rather short, less than one-half length of longest fin-ray; longest rays are first and/or second branched rays. Dorsal fin length moderate. Pectoral-fin rays i,11 to i,14 [i,13]. Pectoral fin length moderate, usually not extending posteriorly to vertical through pelvic-fin origin. Cleithrum large, anterodorsal border approaches posterior border of preopercle. Posterolateral tips of coracoid bones widely separated. Pelvic-fin rays i,7 in all specimens. Fin moderate in length, tips usually extending to near anal-fin origin. No hooks present on fin rays. Overall shape of pelvic bone modified anteriorly into strong spine. Anterior tips of two pelvic bones diverging widely and usually exserted from body wall. Length of pelvic bone measured from insertion of fin rays to tip of exserted spine 10.0–12.6% of SL, $\bar{x}$ = 11.5 [10.9], up to nearly half of length of bone exserted; distance between anterior tips of spines 5.3–14.2% of SL, $\bar{x}$ = 9.4 [8.3].

Anal fin with 2 or 3 unbranched anterior rays (first ray very small in many specimens examined, suggesting that very small first

ray typically present but not always visible) [2], followed by 20 to 23 branched rays, $\bar{x} = 21.6$ [23]. Last ray divided to base and counted as two rays in most individuals, but in many specimens from Massarabi and Tamaquaré posterior portion of ray unbranched and not included in branched-ray count. Anal-fin margin concave with longer anterior rays forming small anterior lobe; following rays abruptly shorter; fin shape similar in both sexes. No hooks present on anal-fin rays, but absence of hooks on anal- and pelvic-fin rays may be seasonal. Basal sheath of scales on anal fin short, consisting of 5 to 7 scales along anterior portion of fin base. Caudal-fin rays i,9/8,i in all specimens examined. Caudal fin moderate in length, rather narrow, deeply forked, ventral lobe usually slightly larger than dorsal. Adipose fin of moderate size.

Scales in lateral series 33 to 36 [35]. Scale rows in vertical series between dorsal- and pelvic-fin origins usually 7/5 [7/5].

Vertebrae of holotype and 25 paratypes: 33 (1), 34 (20), 35 (5).

Color in life.—Overall coloration of head and body bright silver.

Color in alcohol.—Color description based on holotype (Fig. 1). Scales lacking guanine, ground color pale yellowish tan, slightly darker dorsally. Head with small to medium dark brown chromatophores dorsally and anteriorly. Few large brownish chromatophores ventrally near maxilla and on first infraorbital bones; larger, darker chromatophores on opercle and preopercle. Dark blackish chromatophores extending along base of dorsal fin and posteriorly to dorsal caudal-fin rays. Dark chromatophores present along base of anal fin. Scattered fine dark chromatophores along borders of scales of median predorsal scale row, horizontal scale rows 1 to 3 on region anterior to dorsal fin, and scales of most of body posterior to dorsal fin. Anteroventral portions of body pale except for few chromatophores along scale borders and ventral portions of humeral spots.

Two humeral spots present. Anterior a dusky vertical bar darkest on third and fourth scales of sixth horizontal scale row. Bar extending dorsally into third horizontal scale row and ventrally into ninth scale row; somewhat paler ventral to lateral line. Posterior humeral spot about two scales behind anterior spot. On holotype two humeral spots about same length but posterior spot narrower dorsally and much lighter. Most other specimens with posterior humeral spot smaller. Light dusky midlateral band of widely scattered small dark chromatophores extending from posterior border of posterior humeral spot to caudal-fin base, widening on caudal peduncle to form pale, indistinct caudal spot terminating posteriorly at caudal-fin base. Few large brown chromatophores proximally on membranes of middle caudal-fin rays. Dusky patches on dorsal and ventral lobes of caudal fin aligned with dorsal and ventral corners of caudal peduncle spot.

Dorsal-fin membranes with patch of small black chromatophores forming indistinct horizontal band across middle of fin. Anal fin with band of dusky chromatophores along middle of fin and basal dusky spot anteriorly. Median portion of pectoral fin dusky. Dorsal border of adipose fin with several black chromatophores. Pelvic and pectoral fins almost clear.

Etymology.—The specific epithet, *scologaster* from the Greek *skolos,* thorn or pointed object, and *gaster,* stomach, refers to the exserted spinous pelvic bones on the ventral surface of the body of this species.

Relationships.—The common possession of an exserted pelvic bone and *Astyanax*-type dentition (see "Diagnosis") unites *Astyanax scologaster, A. mucronatus, A. essequibensis,* and *A. zonatus.* The exact relationships of the species within this grouping remain unresolved.

Ecology.—*Astyanax scologaster* is an inhabitant of the black-water main river channels and tributary streams over much of the Río Negro basin. The species has been cap-

tured both along the margins of the swiftly flowing main channel of the Río Negro and in slowly flowing terra-firma tributary streams. Comparative daytime and nighttime sampling with nets at two localities on the upper Río Negro has shown that the species is active at night, but absent during the daylight hours (RPV, pers. obs.).

Comparative material examined.—*Astyanax mucronatus* Eigenmann: FMNH 53520, holotype; Guyana, Essequibo, Potaro River, Tumatumari Cataract.—FMNH 53521, 5 cotypes; CAS 39347, 4 cotypes; MCZ 29963, 1 cotype; Guyana, Essequibo, Potaro River, sandbank at Tukeit.

Astyanax essequibensis Eigenmann: FMNH 53519, holotype; CAS 39144, 24 paratypes; SU 21956, 5 paratypes; Guyana, Essequibo, Potaro River, Tumatumari Cataract.—FMNH 52962, 11 cotypes; MCZ 29958, 2 cotypes; CAS 39146, 23 cotypes; Guyana, Essequibo, Essequibo River, Crab Falls.

Astyanax zonatus Eigenmann: MCZ 20768, 1 syntype; MCZ 20766a, 1 syntype; MCZ 20753, 2 syntypes; Brazil, Amazonas, Rio Solimões, Tabatinga.

Deuterodon pinnatus Eigenmann: FMNH 53525, holotype; FMNH 53526, 3 paratypes; MCZ 29952, 2 paratypes; Guyana, Essequibo, Potaro River, Amatuk Cataract.—MCZ 29951, 2 cotypes; Guyana, Essequibo, Essequibo River, Warraputa Cataract.

Deuterodon acanthogaster Eigenmann: FMNH 54748, holotype; Brazil, Mato Grosso do Sul, Corumbá.—FMNH 54750, 5 cotypes; Brazil; Mato Grosso do Sul, Rio Jaurú, SW of São Luis de Caceres.—USNM 232385, 3; Paraguay, Amambay, Río Aquidaban, Parque Nacional Cerro Cora.—MZUSP 30868, 5; Brazil, Para, Rio Itacainos, Serra dos Carajás.—MZUSP 30543, 5; Brazil, Para, Rio Tapajos between Jacaréa-Canga and Itaituba.

Remarks.—Eigenmann (1911:180, Fig. 2) in his original description of *Deuterodon acanthogaster* noted that the species was characterized by protruding innominate bones (= pelvic bones) but did not comment on the presence of the structures in any other members of the genus. Comparative studies associated with this study have disclosed comparable spines in *Deuterodon pinnatus* Eigenmann.

Resumen.—*Astyanax scologaster* es descrita provenientes de varias localidades del medio y alto Río Negro de Venezuela y Brasil. Esta especie se caracteriza por poseer la sección anterior de los huesos pélvicos modificados en unas espinas lateralmente divergentes, las cuales se extienden a través de la piel en la mayoría de los individuos. Una modificación similar ha sido observada en *Astyanax essequibensis, A. mucronatus, A. zonatus, Deuterodon pinnatus,* y *D. acanthogaster.* Las tres especies de *Astyanax* con los huesos pélvicos prominentes pueden ser distinguidas de las especies de *Deuterodon,* por una serie caracteres dentales. *Astyanax scologaster* se diferencia de sus congéneres por poseer 21 ó 22 radios anales bifurcados, comparado con 24 ó 25 en *A. mucronatus,* 19 ó 20 en *A. essequibensis* y 25–29 in *A. zonatus.* Los patrones de coloración y diferencias morfométricas y merísticas, distinguen aún más a *A. scologaster* del resto de las especies.

Acknowledgments

The specimens that served as the basis for this study were collected by a joint MBUCV-USNM expedition to the upper Río Negro, and as a corollary to AMNH collecting efforts associated with the expedition to Cerro de la Neblina National Park organized by La Fundacion para el desarrollo de Las Ciencias Fisicas, Matematicas y Naturales. We thank Dr. Antonio Machado-Allison (MBUCV) for his efforts in organizing the MBUCV-USNM expedition. He, along with Mr. Carl J. Ferraris, Jr., Lic. Justa M. Fernandez, Lic. Otto Castillo, and Sr. Ramiro Royero assisted in collecting the specimens. Specimens from the Brazilian portions of the Rio Negro were collected in

1979 by Dr. Michael Goulding, then of the Instituto Nacional de Pesquisas da Amazonia, Manaus, Brazil. That material, subsequently sorted and housed at the Museu Paraense Emilio Goeldi, Belém, Pará, Brazil, and now deposited at MZUSP, was loaned for this study by Dr. Naércio A. Menezes. Mr. Andrew G. Gerberich, Mr. Kurt A. Bruwelheide and Ms. Ann M. Williams provided technical assistance at USNM. Figures 1 and 2 were prepared by Mr. Theophilus Britt Griswald. The Spanish translation of the "Resumen" was provided by Dr. Antonio Machado-Allison. Participation by one of us (RPV) in collecting efforts on the upper Río Negro was made possible by a grant from the Scholarly Studies Program of the Smithsonian Institution. Research associated with this study was supported in part by the I.E.S.P. Neotropical Lowland Research Program of the Smithsonian Institution. This paper was improved by the comments and suggestions of Dr. Stanley H. Weitzman and Dr. Wayne C. Starnes.

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